e-navigation

An end-user's input

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This article is based on a presentation given at a seminar on e-navigation, hosted by the International Association of Lighthouse Authorities at Trinity House in London in July and attended by the IMO Secretary General, the IALA Secretary General and many other leading industry representatives. IALA asked the Institute to highlight the mariner's perspective.

The concepts described here were developed by Captain Krishnamurthi, a sailing master and one of the Institute's Vice Presidents. His well-received paper reflects his own vision of how e-navigation can support modern mariners.

The IMO and IALA should be congratulated for embracing the concept of e-navigation. At last year's IALA conference in Shanghai, the Secretary General of IMO, Mr Mitropoulos, said: 'Those who actually practice navigation need to be involved in the process'. We see a major role for The Nautical Institute in providing the end-user's perspective to e-navigation. Our Institute has committed the resources of our membership and knowledge base to support the concept. We promise to engage constructively with the e-navigation design process and we will do that by bringing in the too-seldom heard voice of the active seagoing professional.

This is the world I live in:
● The ships we command range from small to big, young to old, slow to fast, shipshape to sloppy.
● The operators of my ship, as well as my crew, come from work cultures, training backgrounds and value systems as varied as the whole United Nations.
● Compared with aircraft cockpits, our bridge designs as they exist today are ergonomic nightmares with very little thought about operators' needs.
● We sail into all types of port facilities around the world. The standards of ship/port interface range from safe to hazardous, as we move freight from one region of the globe to another.
● In the discharge of our responsibilities, we in the maritime transport business are regulated by flag state, inspected by port states, supervised by managers, motivated by professional pride and peer pressure, encouraged by mentors and trainers, but above all, driven by the freight that pays for our service.

Bridge ergonomics

The convoluted, uncoordinated use and presentation of navigational information on the bridges of most ships is a direct result of not consulting the navigators who will eventually use it. To give just a few small examples, the navigational charts are placed in one region of the bridge, while the VHF radios are in a remote corner from where you can't see the radar screen. The compass and steering stand are located at a point where the engine control panel is tantalisingly out of sight. The echo sounder is on a bulkhead somewhere while the location of the manoeuvring data is anybody's guess.

You need to jump over the helmsman to take a peek at the magnetic compass, but only have to stumble over the pilot's chair at night to get to the binoculars.

It is a tribute to the adaptability of the much maligned human element that we are getting away with so few navigational accidents, despite such disastrous bridge designs on most ships.

The truth is, these bridge designs are more than adequate and appropriate for an ocean passage. They keep us awake and literally on our feet. But when we sail into a high-traffic, shallow water, sensitive port area at high speeds, that's when we all wish we could have a private word or two with the designers of the navigator's workplace.

If e-navigation can satisfactorily address this one issue alone, we are more than three quarters of the way to our goal.

Integrated navigation

We mariners operate to a very ancient and sacred principle of navigation – it is called, quite simply, cross-check. It is not redundancy, where you revert to a secondary system only after the primary fails. No, we verify the data integrity of the primary system against the secondary as a matter of routine navigational practice. It is critical that navigational data, such as own position, course etc, must be presented from at least two sources which are independent from one another in every sense of the word.

In my opinion, e-navigation should address at least the following integrated navigation systems user needs:
1. An agreed passage plan, electronically authenticated by all players – mariners,

e-navigation

E-navigation is an IMO initiative. It is a concept that incorporates systems and services and is defined as:
● The harmonised collection, integration, exchange and presentation of maritime information onboard and ashore by electronic means to enhance berth to berth navigation and related services, for safety and security at sea and protection of the marine environment.

pilots and VTM – preferably before the ship enters the fairway system. The ship's particulars and manoeuvring characteristics may be incorporated into the digital passage plan to allow for wheel-over points, turning radius, target rate of turn, speed limits and hydrodynamic interactions.

2. A shared risk analysis of each vessel's operation between ship and VTMS. This is a call to move away from: 'Is everything on board in tip-top condition, Captain – we may hang you if it's not' type of mindset to: 'You show me your ship's risky side, we'll show you ours, and we'll take it from there.'

3. A presentation of available aids to navigation that are *relevant to the given passage plan alone* and their current operational status.

4. A list of real-time navigational warnings, such as drifting containers, weather and visibility conditions and currents.

5. Real-time information of own position and true vectors. It will be very comforting to be advised of the current data integrity of the primary position fixing system and also the availability of a secondary system to cross-check.

6. Actual, true, correct depth of water along the planned passage up to the berth. You have no idea how the lack of this information can distract the navigator's mind.

7. The position and vectors of other traffic within the range of 12 miles. I can live without knowing whether the pilot has boarded MV *Nantucket* in the locks 36 miles downriver. In short – no information overload, please.

8. The next two waypoints of other traffic only within a six mile range.

9. A digital passage execution record that will eliminate the bureaucratic distraction that has navigators filling in the famous bell book with record of every buoy, breakwater and duck they pass by.

AIS/VHF format

The maritime community doesn't seem quite clear what the purpose of AIS is. Is it for enhanced navigational safety? Is it a secondary collision avoidance tool? Or is it for enhanced security? The United States Coast Guard certainly seems to think so. AIS has far greater value to VTM/pilots and port services: to the mariner, it certainly doesn't form the building block of e-navigation. It hasn't even reached acceptable data integrity levels and its presentation format is badly in need of standardisation.

Out in the blue oceans, I do not encourage VHF negotiations for collision avoidance on my ship. The Colregs are adequate for that purpose in all waters.

However, we need to recognise the value of the VHF as a tool of effective traffic management in high traffic areas, such as ports and TSS.

When AIS/VHF technology is upgraded in the future to meet e-navigation needs, two features would add real value to these systems:

■ The first is text-based, menu-driven communication between ships and VTMS with translation options. This will address the issue of language and accent barriers.

■ One-to-one or one to several voice communications system. This arises from the need to protect the ship's bridge from the constant chatter on the VHF that drives us all to distraction.

Both systems could also be effective vehicles for query, alert and alarm protocols between ships and also between ships and VTMS.

The 's' word

I have come to grief using the 's' word in other forums. But I persist in saying that standardisation of navigational systems is the crying need of the day. This is something we must learn from the aviation industry. Standardised configurations have a positive impact on operator training and familiarisation. The only way to achieve this is through the IMO and flag states. With the development of the default S-mode, standardisation need not conflict with customisation needs of vendors and clients. The aspects of such standardisation should include, as a minimum:

1. The layout, dimensions and display formats;

2. Simple user interface for customised settings;

3. A default S-mode to revert to at the push of a single button. The Nautical Institute is leading this S-mode project and is receiving overwhelming and positive response from our membership;

4. Performance verification features;

5. Durability and endurance of the components to marine standards. We subject our ship, its equipment and ourselves to rather serious stress at sea;

6. Standardisation of bridge alarm protocol.

Other issues

Voyage data recorders which will be fitted on ships very soon can be more than just black boxes. The data may be organised to enable voyage analysis by all parties during the normal course of a ship's life. The intention is to review, learn and prevent situations which result in the

black box being the only object remaining of the ship. The VDR has the potential to be used as a learning tool rather than just a post-mortem device.

Small craft traffic: A shipmaster's biggest nightmare comes in the smallest of packages. Fishing craft, barges, pleasure craft are operated mostly by unlicenced persons in busy shipping lanes and no coastal state has so far thought fit to control this situation. One hopes the e-navigation master plan includes the commitment of coastal states to organise traffic in a strict lane system based on speeds, size and operational parameters.

System reliability

Onboard ships, we have so far worked with stand-alone navigational equipment with their own error margins, alarms and response mechanisms. As we integrate all these components into a convenient single window display, I am concerned that systemic errors in individual components will impact the final output significantly and also may go unnoticed until too late. To address this we need to run what-if flowcharts right at the design stage for every possible combination of events and worst case scenarios.

This exercise alone will highlight:

● The need for approved and field-tested system integrity;

● The principle of cross-checks;

● Redundancy provisions.

Human element

For a mariner, training for new technology is not as tough a challenge as it is made out to be. Mariners are accustomed to training programmes as integral to their careers. They are extremely adaptable, especially among the younger generations. We are more likely to encounter roadblocks with training service providers whose faculties are usually soaked in the ethos of traditional navigational procedures. Simple, approved simulators and e-learning programmes with stress on skill development and conceptual learning will do the trick.

Finally, we also need to evolve a comprehensive strategy to address psychological and emotional issues that arise out of the man-machine interface: issues like boredom, complacency, positive and dynamic engagement of the human mind, information overloads and many more. Not defining a clear role for the human element in the e-navigation matrix could have more serious repercussions than not undertaking the e-navigation journey at all.